EFFECTS OF DIFFERENT FEEDS FOR THE SURVIVAL POTENTIAL ON EARLY LARVAL STAGE OF WHITE BLOTCH SNAPPER, *LUTJANUS RIVULATUS*

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BORNEO MARINE RESEARCH INSTITUTE
UNIVERSITI MALAYSIA SABAH

2007

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JUDUL : **EFFECTS OF DIFFERENT FEEDS FOR THE SURVIVAL POTENTIAL ON EARLY LARVAL STAGE OF WHITE BLOTCH SNAPPER, LUTJANUS RIVULATUS**

IJAZAH: **SARJANA SAINS (AKUAKULTUR)**

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Tarikh: 2008

CATATAN: ®Tesis dimaksudkan sebagai tesis Ijazah Doktor Falsafah dan Sarjana secara penyelidikan atau disertassi bagi pengajian secara kerja kursus dan penyelidikan, atau laporan Projek Sarjana Muda (LPSM).

CERTIFICATION

NAME : **CHING FUI FUI**

MATRIC NO. : **PS04-004-010**

TITLE : **EFFECTS OF DIFFERENT FEEDS FOR THE SURVIVAL POTENTIAL ON EARLY LARVAL STAGE OF WHITE BLOTCH SNAPPER, *LUTJANUS RIVULATUS***

DEGREE : **MASTER OF SCIENCE**

VIVA DATE : **6 SEPTEMBER 2007**

DECLARED BY

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DECLARATION

The materials in this thesis are original except for quotations, excerpts, summaries and references, which have been duly acknowledged.

6 SEPTEMBER 2007

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ACKNOWLEDGEMENT

I would like to express my sincere indebted acknowledgement to my supervisor, Prof. Dr. Shigeharu Senoo from Borneo Marine Research Institute, for his invaluable suggestions, guidance and encouragement throughout study period.

I thank Universiti Malaysia Sabah for the endless assistantship. I would like to express my gratitude to Prof. Saleem Mustafa, Director of Borneo Marine Research Institute, Prof. Dr. Ridzwan Abdul Rahman, Director of Centre for Research Management and Conference (Former Director of Borneo Marine Research Institute), Prof. Datin Dr. Maryati Mohamed, Dean of Centre for Postgraduate Studies and Prof. Datuk Dr. Mohd. Noh Dalimin, Vice-chancellor, Universiti Malaysia Sabah, for their encouragement and assistance within the completion of this thesis.

My sincere appreciation is also extended to Dr. Yoshizumi Nakagawa, postdoctoral researcher of Kinki University for supporting, giving meaningful comments and advice, encouragement and assistance to complete my study.

My special thank to National Environment Fellowship (NEF), Japan for granted me a NAGAO scholarship as a study financial aid. I extended my appreciation to UMS NAGAO committee for all the direct or indirect assistantship.

My heartfelt thanks to Dr. Shahbudin Saad, Dr. Sitti Raehana Muhd. Shaleh, Dr. Yukinori Mukai, Mr. Montinius Guntalib, Ms. Siti Badra, Mrs. Rosliah Lawrence, and all the staff of Borneo Marine Research Institute for their co-operation. I wish to heartily express my indebtedness to Mr. Norazmi Osman, Mr. Henry Lipan, Mr. Herman Musanna, Mr. Ha Hou Chew, Ms. Sow Sok Hui, Ms. Nguang Siew Ing, Ms. Mok Wen Jye, Ms. Chun Kia Huey, Ms. Esther Michelle Gunben, , and all the staffs of UMS Hatchery, Borneo Marine Research Institute for their assistance, and well-wishers for their valuable inputs directly or indirectly for the successful completion of the thesis.

Special note of thanks to my parents, Mr Michael Ching Eng Huat and Mdm. Melia @ Angelina Binti Molondoi for their love, patience, support, understanding and encouragement for me to complete my study. My indebted thank to my siblings for their endless support, love and care in completing my study. Last but not least, I would like to express my gratitude to my fiancé, Mr. Redzwan Japri and family for their love, encouragement, understanding and support to make my study possible

ABSTRACT

EFFECTS OF DIFFERENT FEEDS ON THE SURVIVAL POTENTIAL OF EARLY LARVAL STAGE OF HOI TAI KAI, *LUTJANUS RIVULATUS*

The high mortality in the early larval stage of Hoi Tai Kai, *Lutjanus rivulatus* had caused to the failure in seed production. Three factors were responsible for the mass mortality: Small body size at hatching (2.19 mm), small mouth size at first feeding (80 µm) and short nutrition transition period (18 hours). The difficulty of larvae to consume rotifer, *Branchionus* sp. had restricted the success first feeding. The available rotifer (150-230 µm) is considered too large for the small mouth size larvae to consume. Five artificial feeds and two live feeds were tested as starter feed in this study: boiled egg yolk (BE),cod oil juice (COJ), raw egg yolk (RE) and combination feeds of BE and COJ (BE+COJ), combination feeds of BE and RE (BE+RE), rotifer and natural plankton. The effect of these different feeds to the survival potential of larvae was indicated. Finding shows larvae were only able to consume artificial feed based on the gut content observation. BE was found able to contribute the highest survival rate (87.7±3.3) and larvae succeed to survive in 9 dAH. The factors cause BE to become the most effective starter feed for larvae. Several factors responsible for the success use of BE: consumable by larvae, offer wide range of size (10-180 µm), highly preferred to be consume, Chesson index α (0.99), short gut passage time at the fist feeding day (30 minutes), resembles an attractive feed for the visual feeder larvae to detect feed in the rearing water as well as able to being nutritious feed for larvae.

Keywords: *Lutjanus rivulatus*, first feeding, survival potential, selectivity of feed size, selectivity of feed type.

ABSTRAK

Kadar kematian yang tinggi pada Hoi Tai Kai, Lutjanus rivulatus pada peringkat awal lavi telah membantutkan usaha pengeluaran benih ikan ini. Tiga faktor telah dikenalpasti menyebabkan kematian lavi: menetas pada saiz badan yang kecil (2.19 mm), saiz mulut yang kecil pada hari makan pertama (80 µm) dan masa penukaran nutrisi yang pendek (18 jam). Ketiga-tiga faktor ini telah menyebabkan kesukaran lavi.untuk makan pada hari makan pertama. Rotifer, (150-230 µm) makanan asas pada lavi adalah telalu besar untuk lavi memakannya. Justeru ini, lima jenis makanam tiruan: rebusan kuning telur ayam (BE), jus minyak kod (COJ), telur ayam mentah (RE), kombinasa BE dan COJ (BE+COJ) dan kombinasi BE dan RE (BE+RE) dan 2 jenis makanan hidup: rotifer, Brachionus sp. dan plankton telah diuji bagi mendapatkan makanan yang sesuai bagi lavi dan sekaligus mampu memberi kadar kehidupan yang tinggi. Hasil kajian menunjukan lavi berupaya makan semua makanan yang diuji kecuali makanan hidup. Ini dapat dibuktikan melalui kandungan perut lavi. BE merupakan makanan yang mampu memberi kesan kehidupan yang paling tinggi kepada lavi (87.7±3.3) berbanding lavi yang diberi makanan lain. Lavi ini berupaya untuk hidup selama 9 hari selepas menetas (dAH). BE dirumuskan sebagai makanan terbaik pada lavi dalam kajian ini berdasarkan kebolehannya untuk: hadir dalm pelbagai saiz (10-180 µm), menjadi makanan yang digemari, Chesson indeks α (0.99), masa lalu usus yang pendek (30 minit), mempunyai nilai nutrisi yang baik, dan juga merupakan makanan yang mempunyai ciri-ciri yang mampu menarik minat lavi.

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LIST OF ABBREVIATIONS

%	percentage
&	and
µm	micrometer
AH	after hatching
BE	boiled egg yolk
BL	body length
BW	body weight
COJ	cod oil juice
DHA	docosahexaenoic acid
DO	dissolved oxygen
EPA	eicosapentaenoic acid
ESD	equilibrium spherical diameter
FAO	*Food and Agriculture Organisation*
FFA	free fatty acid
FRP	fibreglass reinforced plastic
g	gram
h	hour
hAH	hour after hatching
HDPE	high density poly ethylene
HP	house power
IU	international unit
kg	kilogram
kj	kilojoule
/	litre
L	length
m	number of tested feed
mg	milligram
mL	mililiter
mm	millimetre

n	number
°C	degree celsius
pH	potantra of hydogeni (power of hydrogen)
ppt	part per thousand
r	r/ propotion
r.p.m	revolution per minute
RE	raw egg
V	volume
W	width
α	alpha
Л	pi

CHAPTER 1

INTRODUCTION

1.1 HOI TAI KAI, *Lutjanus rivulatus*

Lutjanus rivulatus is classified in the genus of Lutjanus, class of Actinopterygii (ray-finned fishes), order of Perciformes (perch like), family of Lutjanidae (snappers); subfamily of Lutjaninae (Allen, 1985). The common names are White blotch snapper and Blubberlips (Allen, 1985). In Sabah, Malaysia, *L. rivulatus* is known by various names such as Ketambak, Konai, Nai Wong, Hoi Tai Kai, Hai Ti Chi and Siak Bong (Chin, 1998).

Many different names are given to *L. rivulatus* (Table 1.1) due to the wide distribution. *L. rivulatus* can be found in most tropical countries, particularly in Southeast Asia (Lee, 1998), such as Malaysia, Indonesia and Philippines, and other countries, namely Japan, Australia, Africa, United States of America and United Kingdom.

Table 1.1 Names of *Lutjanus rivulatus* in different countries (Allen, 1985)

Country	Names
Africa	Speckled snapper
America	Blubberlips snapper
Australia	Maori-seaperch
China	Hai Ti Chi
Indonesia	Gaga
Japan	Nami-fuedai
Malaysia	Hoi Tai Kai
Philipines	Agak-agak

L. rivulatus is one of the most outstanding fish in the seafood industry (Polovina & Ralston, 1987; Department of Fisheries Sabah, 2004). In recent years, *L. rivulatus* has become one of the most expensive marine food fish (Senoo *et al.,* 2002; Department of Fisheries Sabah, 2004). In Kota Kinabalu, Sabah, *L. rivulatus* is sold for RM 120 -160 per kg in seafood restaurants (Own survey in July 2006). The meat quality of *L. rivulatus* is superior. This makes *L. rivulatus* often being the favorite food fish in both local and overseas markets.

Due to the meat quality, the demand for *L. rivulatus* in the seafood industry has gradually increased, while, the outstanding price has generated interest among seafood operators to commercialize *L. rivulatus* in order to gain higher profit (Chin, 1998). However, *L. rivulatus* is widely harvested from the wild to meet the increasing market demand. The continuous harvest of *L. rivulatus* has caused the population to decrease in the wild (Andrade, 2003). As a result, the supply of *L. rivulatus* has become insufficient, causing an imbalance in the market demand and supply (Andrade, 2003).

1.2 *L. rivulatus* SEED PRODUCTION IN UMS HATCHERY

The inconsistent supply of *L. rivulatus* in the market has led to the need of the seed production. It is aimed to produce sufficient supply of *L. rivulatus* to the market. In 2004, the Marine hatchery of Borneo Marine Research Institute, Univerisiti Malaysia Sabah (UMS hatchery) has started the effort to produce *L. rivulatus* seeds through aquaculture. Broodfish of *L. rivulatus* were collected from the wild and reared in the UMS hatchery. Reared broodfish are consistently produce eggs under the artificial condition.

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